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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : A62C 31/03, B05B 1/12, 1/16 — A1

(11) International Publication Number: WO 94/06517

(43) International Publication Date: 31 March 1994 (31.03.94)

(21) International Application Number: PCT/FI93/00366

(22) International Filing Date: 14 September 1993 (14.09.93)

(30) Priority data:

924119	15 September 1992 (15.09.92)	FI
924120	15 September 1992 (15.09.92)	FI
933873	3 September 1993 (03.09.93)	FI

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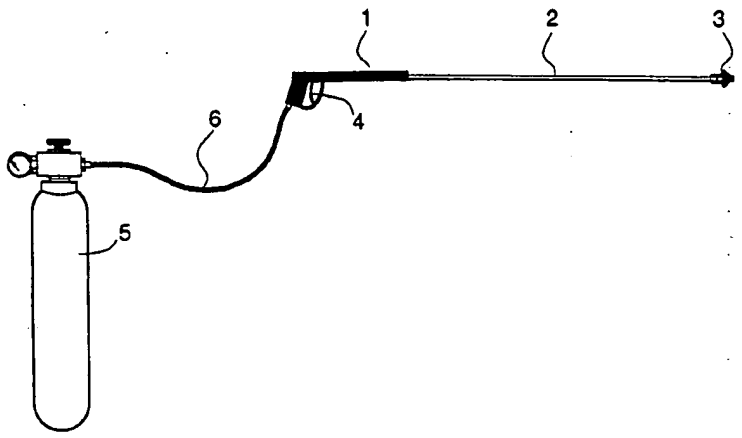
(81) Designated States: AT, AU, BB, BG, BR, BY, CA, CH, CZ, DE, DK, ES, FI, GB, HU, JP, KP, KR, KZ, LK, LU, MN, MW, NL, NO, NZ, PL, PT, RO, RU, SD, SE, SK, UA, US, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: METHOD AND DEVICE FOR FIRE EXTINGUISHING BY ALTERNATING A LIQUID FOG AND A LIQUID JET



(57) Abstract

The object of the invention is to provide a new method for fighting fires, which method requires a small amount of extinguishing liquid for extinguishing a fire and for preventing reignition. When fighting fires in apartments and the like the fire is at first suppressed by spraying fog-like liquid, and thereafter a concentrated liquid spray is directed into the smouldering fire seat. For this purpose it is suggested to use a pistol-like extinguisher (1) with a hydraulic accumulator (5) as a drive unit and provided with a spray head (3) which at first, when the pressure in the hydraulic accumulator is high, produces a fog-like liquid spray and later, when the pressure in the hydraulic accumulator is reduced, produces a concentrated liquid spray. When fighting fires which develop intensive heat the fire is first suppressed by spraying a water jet from a relatively long distance, and thereafter extinguished by spraying a liquid fog at close range. For this purpose it is suggested to arrange, in parallel with a fog-producing spray head, a separate nozzle for producing a forceful, concentrated water jet. To shift from spraying liquid fog to spraying water jet, and vice versa, a conventional valve can be used.

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Method and device for fire extinguishing by alternating a liquid fog and a liquid jet.

The present invention relates to a method and equipment for fighting fire.

One often occurring problem with different kinds of fires is that the fire seat even after that the fire has been suppressed remains smouldering for a rather long time, with a great risk for reignition.

The object of the invention is to provide a new method and new equipment for fighting fires, which method and equipment require a small amount of extinguishing liquid for extinguishing a fire and for preventing reignition.

The method according to the invention is mainly characterized in that the fire is extinguished by a combination of spraying a liquid fog and of spraying a liquid spray.

When fighting fires in apartments and the like the fire is at first suppressed by spraying fog-like liquid and thereafter a concentrated liquid spray is directed into the smouldering fire seat.

For the purpose is suggested to be used a pistol-like extinguisher with a hydraulic accumlator as a drive unit and provided with such a spray head which at first, when the pressure in the hydraulic accumulator is high, produces a fog-like liquid spray and later, when the pressure in the hydraulic accumulator is reduced, produces a concentrated liquid spray.

Oil fires and other fires comparable thereto often develop, however, such an intensive heat that one can't get close enough to reach the fire by means of a liquid fog spray. Neither will a direct water jet on the fire seat or fire surface be successful, because the water turns to steam in an almost explosive manner.

For fighting such fires it is according to the invention suggested that the fire is at first sprayed with a water jet, from a relatively long distance, in order to achieve a rain-like spray with a good cooling effect, and thereafter the fire is extinguished by spraying a liquid fog at close range.

The equipment according to the invention comprises at least one spray head provided with a number of nozzles preferably arranged mutually in accordance to what is described in the international patent application PCT/FI92/00155. Such spray heads are, with a low liquid consumption and preferably utilizing a high operating pressure, even up to about 300 bar, capable of producing an effective extinguishing liquid fog which can be a relatively concentrated fog spray with a good penetration power.

In a preferred embodiment of the invention there is, in parallel with such a spray head, arranged a separate nozzle for producing a forceful, preferably concentrated water jet. For shifting from spraying a liquid fog to spraying a water jet, and vice versa, a conventional valve can be used. This embodiment is well suited both for fighting smouldering fires and for fighting oil fires and the like and can preferably comprise a liquid pump unit of high operating pressure as drive unit.

In another preferred embodiment of the invention the spray head comprises a spring loaded valve spindle which at a high liquid pressure delivers a liquid fog through a centrally arranged nozzle, essentially in the same way as via the other oblique side nozzles, but which at a reduced liquid pressure delivers the major part of the liquid through said central nozzle in the form ofa relatively strong, concentrated liquid jet. This embodiment preferably employs one or a plurality of hydraulic accumulators as a drive unit

and is in particular suited for fighting smouldering fires.

In the following the invention shall be described in more detail with reference to the attached drawing which, by way of example, show two basic embodiments of the invention.

Figure 1 shows a first embodiment of the fire fighting equipment according to the invention, as seen from the side.

Figure 2 is an end view of a spray head included in the embodiment of figure 1.

Figure 3 shows a longitudinal section of the spray head of figure 2, in an inactive state.

Figure 4 shows the spray head in an active state, in a first step.

Figure 5 shows the spray head in an active state, in a second step.

Figures 6 and 7 show an end view and a longitudinal section, respectively, of that end of the valve spindle of the spray head which is positioned towards the central nozzle.

Figure 8 shows a second embodiment of the fire fighting equipment according to the invention, as seen from the side.

Figure 9 is an end view of a spray head included in the embodiment of figure 8.

Figure 10 shows a longitudinal section of the spray head of figure 9.

Figures 11 and 12-14 show a spray head and in an enlargened scale an axial section of an individual preferred nozzle under the influence of different liquid pressures.

Figures 15 and 16 show an axial section of a hand held spray head, at full operating pressure and at a restricted operating pressure, respectively.

The embodiment of figure 1 comprises a pistol-

like maneuvre or control device 1, from the barrel of which extends a tube 2 to a spray head 3. By means of the trigger 4 of the pistol 1 a hydraulic accumulator 5 can be connected or disconnected via a hose 6 joined to the handle of the pistol 1. The hydraulic accumulator 5 can be charged to a drive pressure of as much as about 300 bar.

Figures 2-7 show a preferred embodiment of the spray head 3. The spray head 3 has a number of (e.g. six as in the drawing) obliquely directed side nozzles 7 and a central nozzle 8 directed forward. The side nozzles can preferably be constructed in accordance to what is described in the international patent appplication PCT/FI92/00155. In such nozzles, the extinguishing liquid is set in a strong whirling motion before being discharged through the orifice, e.g. by means of a rotating whirler element 9 with a number of oblique grooves 10, as shown in figure 3, the whirler 9 being set in a fast rotation by the high pressure liquid flowing through the grooves 10. The side nozzles 7, and the central nozzle 8, can be mutually positioned in such a way that they co-operate to form an essentially united fog spray with a good penetration power; reference is again made to the international patent appplication PCT/FI92/00155.

The spray head 3 has a centrally running channel 11 which is joined to the tube 2 and from which distributor channels 12 lead to the respective side nozzles 7. A valve spindle 13 is positioned in the channel 11. A helical spring 14 tends to force the spindle 13 against the inlet 15 of the channel 11, at the tube 2, one end of the spring 14 bearing against the central nozzle 8 and the other end of the spring bearing against a plunger-like portion 16 of the spindle 13, at the inlet end of the spindle. An annular passage 17 is provided between the plunger-

lika spindle portion 16 and the surrounding wall of the channel 11.

The equipment of figures 1-7 is mainly intended for fighting more or less normal fires, e.g. in apartments etc. A common feature for such fires is that they have a tendency to remain smouldering for a relatively long time, with a risk for reignition. In the following the function of the equipment shall at first be descibed generally and thereafter the function of especially the spray head shall be described in detail.

Figure 3 shows the spray head in an inactive state. the tube 2 is disconnected from the hydraulic accumulator 5 and the spring 14 keeps the spindle 13 against the inlet 15 of the channel 11.

In figure 4 the hydraulic accumulator 5 has been connected and the pressure in the tube 2 and in the inlet 15 is so high that the spindle in spite of the spring 14 is driven into bottom position, in abutment against the central nozzle 8. There are open connections from the central channel 11 via the distributor channels 12 to the side nozzles 7 which produce an extinguishing liquid fog. The liquid connection to the central nozzle 6 is rather restricted with the result that the central nozzle produces generally the same kind of a liquid fog as the side nozzles 7.

Gradually the drive pressure of the hydraulic accumulator 5 decreases to such an extent, to e.g. about 100 bar, that the spindle 13 under the influence of the spring 14 takes a position approximately as in figure 5. In this position the the pressure drop over the annular passage 17 balances the force of the spring 14. In this position most of the extinguishing liquid is discgarged through the central nozzle 8 in the form of a relatively forceful concentrated jet,

because the orifice of the central nozzle 8 is larger than the respective orifices of the side nozzles 7.

At the transition from the step of figure 4 to the step of figure 5 the fire is at least seemingly extinguished, but the fire seat may remain smouldering. In order to prevent reignition, the water jet from the central nozzle 8 can be concentrated into the fire seat for definite cooling of the same.

Figures 6-8 show a second embodiment of the equipment of the invention. This second embodiment is in particular intended for fighting oil fires and similar fires which develop intensive heat.

As shown in figure 6, this embodiment comprises a pistol-like maneuvre or control device 30, from the barrel of which extends a first tube 31 to a nozzle 32 and a second tube 33 to a first spray head 34. By means of the trigger 35 of the pistol 30 a high pressure liquid pump 36 can be connected or disconnected via a hose 37 joined to the handle of the pistol 30. The tube 31 is provided with a valve 38 for opening and closing the tube 31.

The nozzle 32 is dimensioned to, when fed by the pump 36, produce a preferably forceful and concentrated water jet

The spray head 3 has a number of (e.g. six as in the drawing) obliquely directed side nozzles 39, preferably of the same kind as the side nozzles 7 in figures 1-5, and a central nozzle 40 directed forward and essentially corresponding to the central nozzle 8 when being in the position of figure 4. Alternatively, the central nozzle 40 may be of the same kind as the side nozzles 39.

The equipment according to figures 6-8 is used in the following way to fight oil fires and similar fires which develop intensive heat.

In a first stage liquid is sprayed through the

nozzle 32 only, from a relatively long distance from the fire seat. The liquid reaches the fire like rain, with a good cooling effect, in particular on hot surfaces. When the fire has cooled enough to enable an approach, the fire is finally extinguished aat close range by means of a liquid fog through the spray head 34.

In the following the function of the embodiments of figures 1-7 shall be described in more detail.

The spindle 13 arranged in the central channnel 11 of the spray head has a thickened portion 16, like a plunger, at its end towards the inlet 15. the plunger 16 forms a stop for the spring 14 and between the plunger 16 and the wall of the channel 11 there is an annular passage 17, which in figures 2-5 has been exaggerated in order to be visible. Through the plunger 16 runs an axial channel 18 which after the plunger, in the thinner portion of the spindle 13 around which the spring 14 is laid, is connected to the channel 11 through branchings 19.

When the hydraulic accumulator 5 is switched on, liquid flows past the plunger 16 through the annular passage 17, and through the plunger along the channels 18 and 19. The annular passage 17 and the channels 18, 19 are so narrow, respectively, that the pressure fall over the plunger 16 is great enough to continuously win over the force of the spring 14, whereat the spindle hits to the bottom against the central nozzle 8, as shown in figure 4. Preferably a connection is provided also in the state of figure 4 from the central channel 11 to the orifice 20 of the central nozzle 8, partly through the annular passage 17 and partly through the channels 18, 19 to the helical spring 14, between the loops of which liquid flows in a helical path to and through a connection 21 between the conical end of the spindle 13 and a

corresponding conical surface in the nozzle 8.

A preferable embodiment of this connection 21, which in figure 4 is visible as two black lines, is shown in figures 6 and 7. The conical end portion of the spindle 13 is indicated by 22 and a number, e.g. four, oblique grooves are indicated by 23. Thanks to the helical path along the spring 14 and the grooves 23 the liquid will be set in a strong whirling motion when being discharged through the orifice 20.

In the embodiment according to figure 10 the central nozzle 40 of the spray head 34 has a helical spring 41 which in the same way as the spring 14 in the position of figure 5 sets the liquid in a strong whirling motion before being discharged through the orifice.

Figures 11-14 show a spray head with an alternative preferred nozzle embodiment which can replace the side nozzles and/or the central nozzles earlier described.

In figures 11-14 the reference numeral 51 indicates a housing of a spray head with an inlet 52 for liquid, preferably of a high pressure, even up to about 300 bar. The inlet 52 continues as an axial channel 53 which in figure 11 leads to a centrally arranged nozzle 54 and from which lead branch channels 55 to side nozzles 56 directed obliquely outwards. The central nozzle 54 and the side nozzles 56 in figure 11 shall in the following be described in more detail with reference to figures 12, 13 and 14 which show a side nozzle 56.

The nozzle 56 has a body or holder 57 which by means of a thread 58 is screwed in a seat joining a branch channel55 in the housing 51 of the spray head. Through the holder 57 runs a connection which, seen in the direction from the channel 55, has a cylindrical portion the wall of which is indicated by 59 and which

ends at an annular stop 60, and a conically narrowing portion with a whirl chamber element 61 which defines a conically narrowing whirl chamber 62 and an orifice 63.

Between the inner en of the holder 57 and a stop 64 formed in the nozzle seat is arranged a filter, preferably a disc-like sintered metal filter 65 having a central opening through which is entered an end pin 66 of a spindle having a cylindrical portion 67 reaching into the cylindrical passage of the holder 57 and terminating in an end surface 68 matching the conical surface of the whirl chamber 62 and provided with a number of oblique grooves 69.

Around the cylindrical portion 67 of the spindle is laid a helical spring 70 with one end bearing against the stop 60 and/or the inner end of the whirl chamber element 61 or the wall of the whirl chamber 62 and the other end bearing against a flange 71 of the spindle said flange 71 in turn bearing against the filter 65. The spring 70 thus tends to press the spindle away from the whirl chamber 62 and to press the filter 65 against the stop 64. The diameter of the flange 71 is a little smaller than the diameter of the cylindrical passage, at 59, of the holder 57, so that there is an annular passage 22 between the flange 71 and the wall 59, when the spindle is driven against the (bottom) wall of the whirl chamber 62, as shown in figure 13.

Along the annular space between the cylindrical spindle portion 67 and the wall 59 of the cylindrical passage is formed a helical path 73 between the loops of the spring 70; the spindle portion 67 and the spring 70 are preferably of such dimensions that practically all of the passing liquid follows the helical path 73, and thereby the liquid is given a strong whirling motion in the whirl chamber 62 and

further out through the orifice 63.

In figure 12 the spray head is either inactive or the active liquid pressure is so low that the spring 70 forces the filter 65 into abutment against the stop 64. The spring 70 is relatively expanded and the cross section of the helical path 73 is relatively wide. A preferably conical extension 76 of the pin element 66 reaches into the inlet channel 55 and closes the orifice of the channel 55. That surface of the flange 71, against which the spring 70 bears, is essentially level with the inner end of the holder 57.

In figure 13 the spray head is activated and the liquid pressure is high. The pressure fall especially over the annular gap 77 between the cone 76 and the surrounding edge of the orifice of the inlet channel 55 and over the annular passage 72 between the flange 71 and the holder wall 59, and to some extent also over the filter 65 and the helical path 73, is so great that the spring 70 is compressed until the filter 65 hits the holder 57, and thereafter the spindle continues the movement on its own, beacuse of the pressure fall over the annular passages 77 and 72. The end surface 68 of the spindle reaches down into contact with the whirl chamber bottom wall and thus the helical path 73 is much narrower than in figure 12. A violently whirling fog-like liquid spray is discharged through the orifice 63.

The driving gas pressure, and thus the liquid pressure, will gradually fall to a value so low that the spring 70 forces the spindle loose from the whirl chamber element 61. The pressure falls especially over the annular passage 72 and over the annular gap 77 now balance the spring 70. As the drive pressure continues to fall, the spring 70 expands further until the conical extension eventually blocks the inlet channel 55, whereat the filter 65 is close at or against the

stop 64.

In the state of figure 14, a desired centered positioning of the spindle is, in spite of the lateral, or radial clearance between the filter 65 and the stop 64 and the clearance 75 between the pin element 66 and the filter 65, ensured by means of the conical extension 76 of the pin element 66. A centered position is desirable in order to obtain an even width for the annular passages 72 and 77 all around and thus to obtain an essentially predeterminable flow resistance through these passages. The liquid flow past the cone 76 automatically centers the spindle structure. It should be noted, however, that a satisfactory result can be achieved in many cases also without an extension 76, i.e. with the pin element ending at or slightly above the filter 65.

By varying the axial length of the cylindrical pin element 66 and/or the tapering angle of the extension 76 it is possible to close the inlet 55 at a predeterminable liquid pressure as the spring 70 with decreasing drive pressure gradually expands from the state of figure 13 through the state of figure 14 back to the state of figure 12. In the embodiment of figures 11-14 the extension 76 closes the inlet 55 just before or just as the filter 65 contacts the stop 64. The extension 76 may of course alternatively have the general form of a truncated cone. If the grooves 69 are omitted, the nozzle will be closed in the position of figure 13 and will open at a predeterminable decreased pressure. The filter 65 plays only a minor, deletable part in creating those pressure falls which govern the function of the nozzle, but a filter is recommendable for cleaning the liquid.

In the state of figure 14 the cross section of the helical path 73 is wider than in figure 13. The

result of this is that the rate of liquid out of the orifice does not decrease in proportion to the decreasing liquid pressure but remains at a surprisingly constant rate, although the whirling motion of the liquid fog successively decreases and the droplet size increases.

The force of the spring 70, as well as the annular passages 72 and 77, can be varied according to varying considerations with respect to liquid rate, droplet sizes, desired drive pressures etc., at different stages of a fire extinguishing procedure.

Individual nozzles in the spray head may be differently adjusted; it is primarily the central nozzle of a spray head, as in figure 11, that can be adapted to differ from the side nozzles, e.g. in such a way that the spring is somewhat stronger than the springs of the side nozzles, whereby it at a decreased liquid pressure is possible to for a longer time maintain a relatively forceful liquid spray or jet in the main direction. This can be utilized in the portable pistol-like fire extinguisher devices as earlier described in such a way that simultaneously with a forceful liquid jet in the main direction, through the central nozzle, a shield of liquid fog is provided by means of the side nozzles, whereby it is possible to approach close to a violent fire developing intensive heat. Such a manually maneuvrable device can without difficulties be constructed in such a way that the operating or liquid pressure can be varied as desired during the extinguishing procedure.

By means of nozzles according to figures 11-14 a particularly favourable effect is achieved when hydraulic accumulators according to the Finnish patent application No. 924752 are used as a drive unit. Such hydraulic accumulators have an outlet tube with wall apertures, so that drive gas is mixed into the

extinguishing liquid after the gas pressure has decreased to a predeterminable level. In the initial stage according to figure 13 a violently whirling liquid fog with small droplets and a good penetration power is achieved, in the beginning of the stage according to figure 14 larger droplets with a good capability of cooling hot surfaces and smouldering fires is achieved, and thereafter, with gradually decreasing drive pressure and increasing amounts of intermixed gas, and gradual return to the state of figure 12, a total flooding with even smaller droplets than during the initial stage of figure 13 can be maintained for a long time.

In fire fighting equipment employing a liquid pump as a drive unit, the nozzles according to figures 11-14 makes it possible to vary the mode of liquid spray during the extinguishing procedure, by varying the operating pressure of the liquid pump, or by arranging valves for throttling the liquid flow and thereby adjusting the pressure.

Figures 15 and 16 show a hand held spray head enabling variation of the operating pressure. The housing of the spray head is indicated by 80, a number of side nozzles are indicated by 81 and a central nozzle is indicated by 82. The side nozzles 81 are of the same kind as in figures 11-14 and the central nozzle 82 operates basically in the way as the central nozzle shown in figures 3-5.

The spray head has a centrally running channel from which distributor channels lead to the respective side nozzles 81. In the central channel and in a holder 83 of the central nozzle 82 is positioned a valve spindle 84, 86. A helical spring 85 is laid around that end portion 84 of the spindle which is towards the nozzle holder 83, one end of the spring 85 bearing against the nozzle holder 83 and the other end

of the spring bearing against a plunger-like portion 86 of the spindle, at the inlet end of the spindle. An annular passage 87 is provided between the plunger-like spindle portion 86 and the surrounding wall of the channel housing 80. An axial channel 88 with a throttle 89 runs through the plunger 86 and is cionnected to the helical flow path formed along and between the loops of the spring 85.

Around the inlet portion of the housing 80 is arranged a sleeve 90 which is turnable along a thread 91 on the inlet end of the housing 80 and thus is axially movable with respect to the housing 80. The inlet channel 92 of the spray head is connected through side channels 93 past a conical portion 94 of the housing along an annular passage 95 between said conical portion 94 and a correspondingly widening surrounding portion of the housing 80 to side channels 96 leading to the inlet end portion 97 of the central channel connected to the side nozzles 81 and the central nozzle 82.

In figure 15 the sleeve 90 has been turned to an outward position, to the right, whereat the annular passage 95 is wide and the operating pressure acts essentially unrestricted in the channel portion 97. The side nozzles 81 are driven to the position shown in figure 13 and the central spindle 84 is driven against the holder 83, as in figure 4.

In figure 16 the sleeve 90 has been turned to an inward position, to the left, whereat the annular passage 95 is narrow. The pressure fall over the passage 95 has lowered the pressure acting in the channel portion 97 so much that the side nozzles 81 are in the position shown in figure 12 and the spring 85 has been able to press the spindle 84 off the nozzle holder 83 and is balanced by the pressure falls over the annular passage 87 and over the throttle 89.

The helical flow path 98 between the loops of the spring 85 is wide and as the connections to the side nozzles 81 are narrow, most of the liquid is discharged through the central nozzle as a powerful liquid jet. If the throttle 89 is blocked and the annular passage 87 is made correspondingly wider, there will be wider connections to the side nozzles 81.

The spray head with the turnable sleeve structure shown in figures 15 and 16 enables in a convenient manner a successive regulation of the operating pressure acting in the nozzles and can be used together with either hydraulic accumulators or a liqiod pump as drive unit. A step-wise regulation can be achieved by means of a two-position shift valve with a throttled port in one position.

Claims

1. Method for fighting fire, characterized in that the fire is fighted by spraying a combination of a liquid fog and a liquid jet.

2. Method according to claim 1, in particular for fighting smouldering fires, characterized in that the fire is in a first step suppressed by spraying a liquid fog and thereafter a concentrated liquid jet is directed into the fire seat.

3. Method according to claim 1, in particular for fighting oil fires and the like which develop intensive heat, characterized in that the fire is at first sprayed with a water jet, from a relatively long distance, in order to achieve a rain-like spray with a good cooling effect, and thereafter the fire is extinguished by spraying a liquid fog at close range.

4. Equipment for fighting fire, characterized in that it comprises a drive unit (5; 36) for delivering extinguishing liquid, preferably at a high pressure, a maneuvre device (1; 30) for switching the drive unit on and off, and means (3; 32, 34) for spraying, alternatively, a liquid fog or a liquid jet.

5. Equipment according to claim 4, characterized in that the drive unit comprises at least one hydraulic accumulator (5), and that the means for spraying, alternatively, a liquid fog or a liquid jet comprise a spray head (3) with a number of side nozzles (7) prefereably directed obliquely to the sides, for producing a liquid fog, and a centrally arranged nozzle (8) which at a high operating pressure is arranged to produce a liquid fog and which after the drive pressure of the hydraulic accumulator has decreased to a predetermined value is arranged to

produce a liquid jet.

6. Equipment according to claim 5, characterized in that the spray head comprises a central channel (11) leading to the central nozzle (8) and connected to the respective side nozzles (7) through branchings, and that a movable spindle (13) is arranged in the central channel, in combination with a preferably helical spring (14) tending to force the spindle against the inlet (15) of the central channel (11) with a force adapted such, that the spindle under the influence of the full charge pressure of the hydraulic accumulator (5) is driven against the central nozzle (8) while maintaining such a connection thereto that enables production of a liquid fog, and that the spindle (13) after the drive pressure of the hydraulic accumulator has decreased to a predetermined value is brought loose by the spring (14) from the central nozzle (8) in order to provide ean essentially wider connection thereto.

7. Equipment according to claim 6, characterized in that the spindle (13) at its end towards the inlet of the central channel (11) has a thickened portion (16) with an annular passage (17) between said portion (16) and the wall of the channel (11),

that through said thickened portion (16) is formed an axial bore (18) ending (19) into the central channel (11) within the thinner portion of the spindle around which the spring is laid, and

that in the end surface (22) of the spindle (13), towards the central nozzle (8) are provided a number of oblique grooves (23) enabling liquid to pass when the spindle is in abutment against the central nozzle.

8. Equipment according to claim 4, characterized in

that the drive unit comprises a high pressure

liquid pump (36), and

that the means for spraying, alternatively, a liquid fog or a liquid jet comprise a spray head (34) with a number of nozzles (39, 40) for producing a liquid fog, and a parallel nozzle (32) for producing a liquid jet.

9. Equipment according to claim 4 or claim 5, characterized in

that at least one of the nozzles (54;56) comprises a helical spring (70) positioned around a spindle element (67) insertable into an at least essentially cylindrical passage in the housing (57) of the nozzle,

said helical spring being at its one end supported adjacent the nozzle orifice and at its other end bearing against a flange (71) of the spindle element (67), said flange (71) having a diameter smaller than the diameter of said cylindrical passage (59) in the housing (57) of the nozzle, to enable an annular passage (72) between the flange (71) and the passage wall (59).

10. Equipment according to claim 9, characterized in that said spindle has a tapered extension (76) forming an annular passage (77) with the surrounding housing.

11. Equipment according to claim 6 or claim 8, characterized by a sleeve element (90) movable along the inlet portion of the spray head housing (80) to form a liquid connection (95) of variable width from the spray head inlet (92) to the nozzles.

12. Equipment according to claim 11, characterized in that said sleeve element (90) is movable along the inlet portion of the spray head housing (80) by turning along a thread (91) on the inlet end of the housing (80).

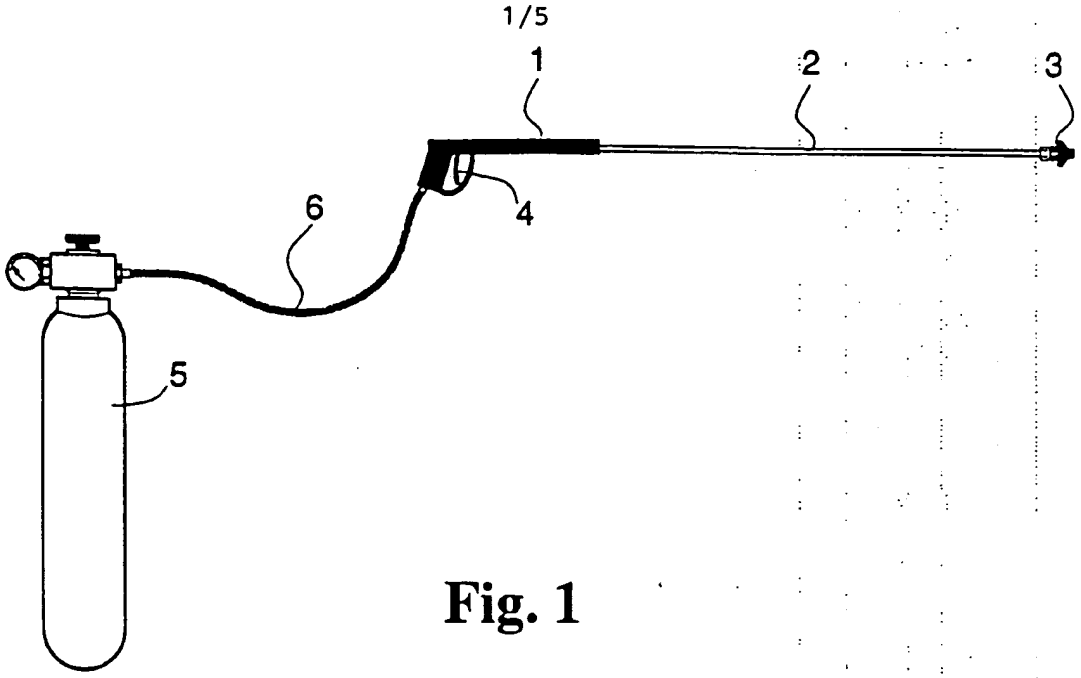

Fig. 1

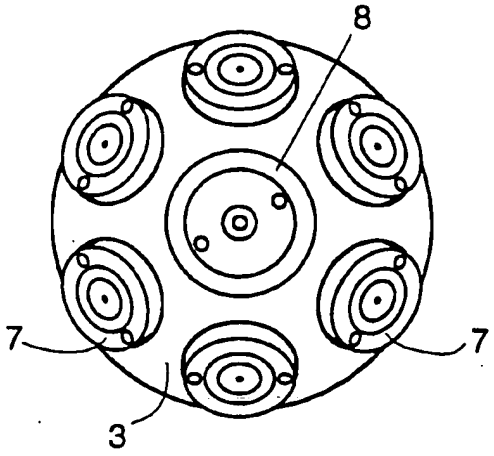

Fig. 2

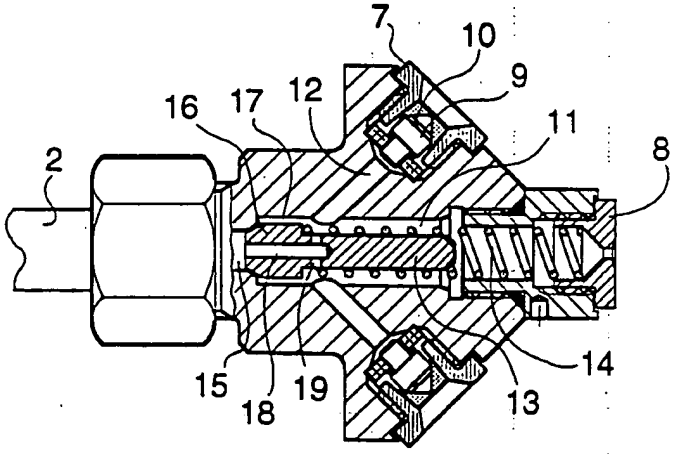

Fig. 3

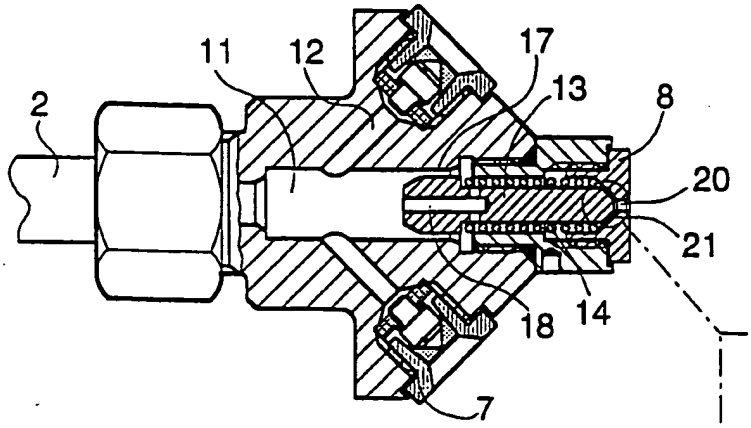

Fig. 4

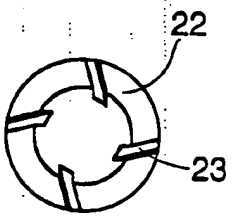

Fig. 6

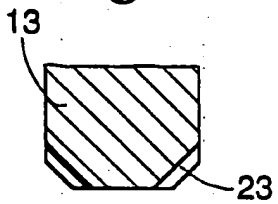

Fig. 7

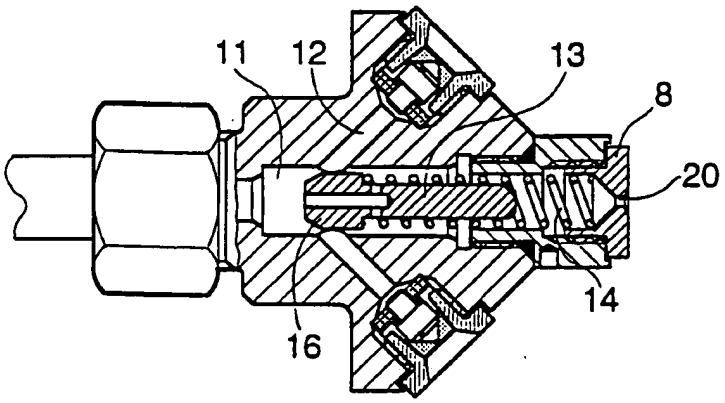

Fig. 5

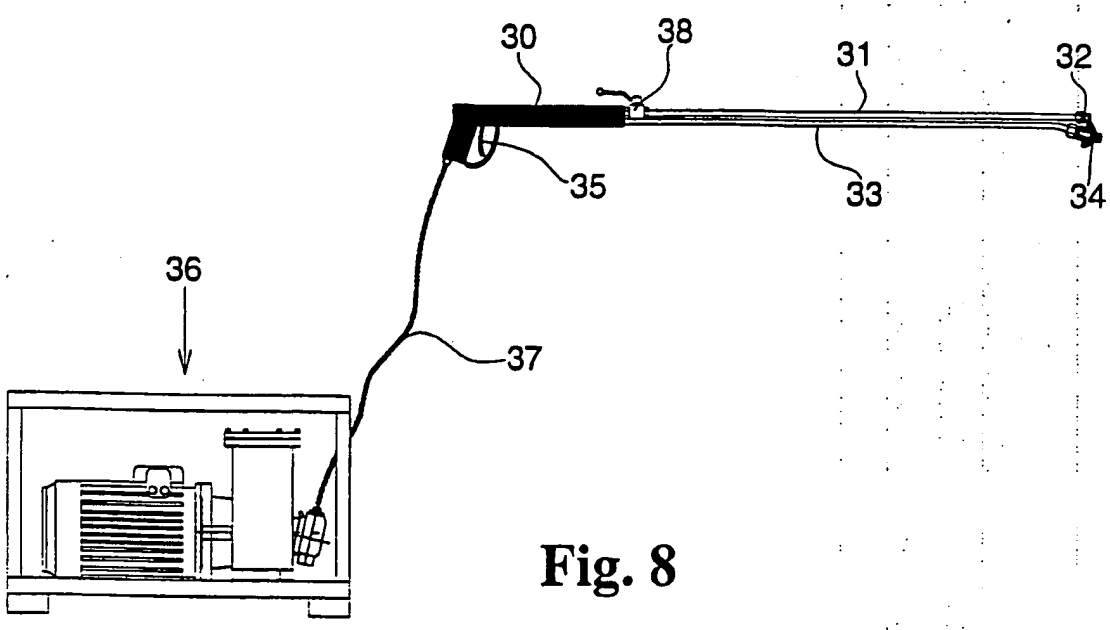

Fig. 8

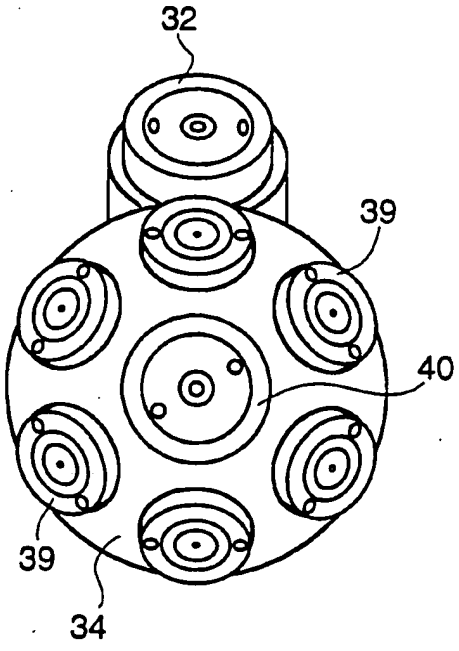

Fig. 9

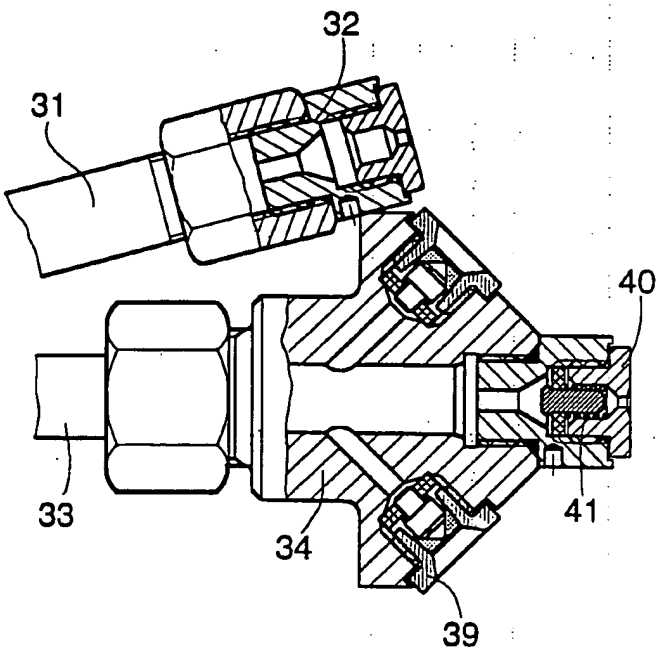

Fig. 10

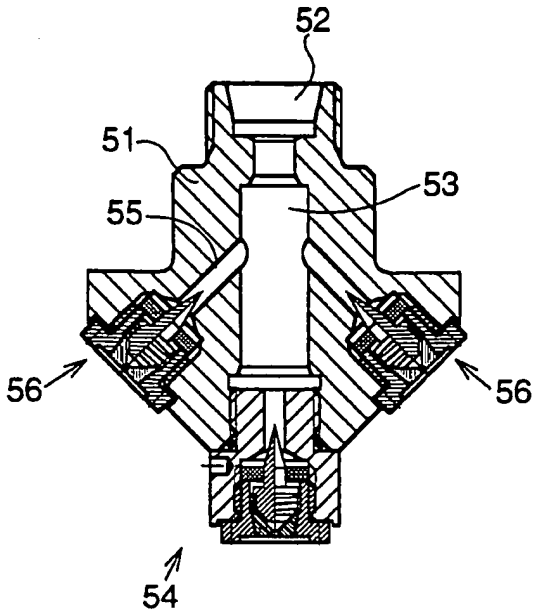

Fig. 11

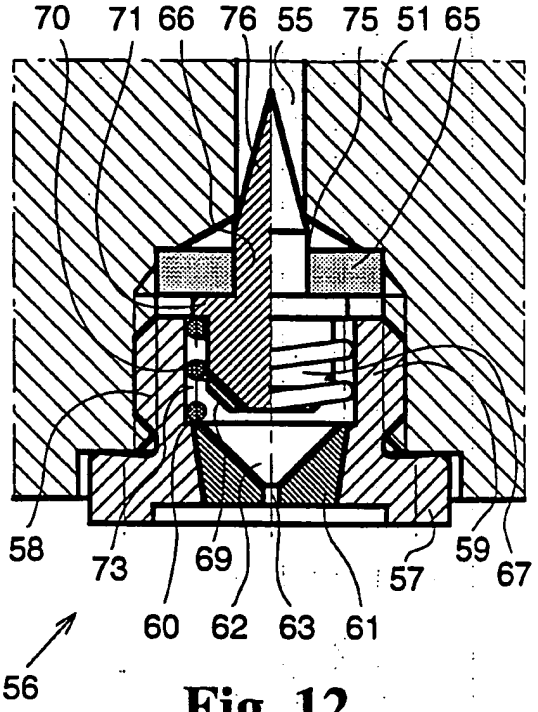

Fig. 12

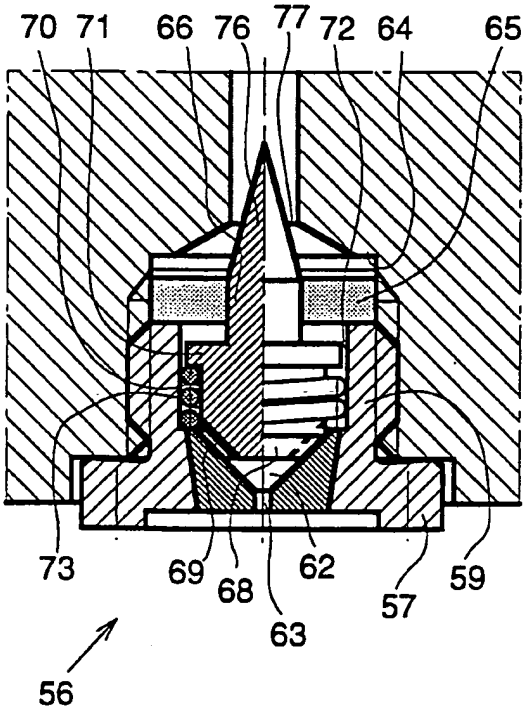

Fig. 13

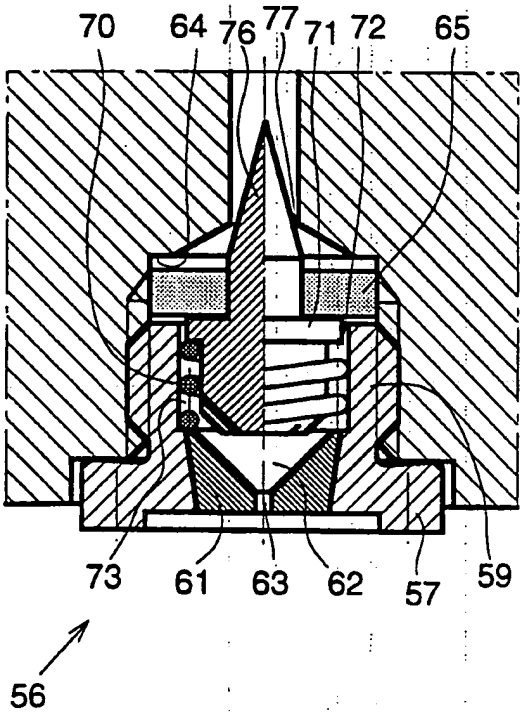

Fig. 14

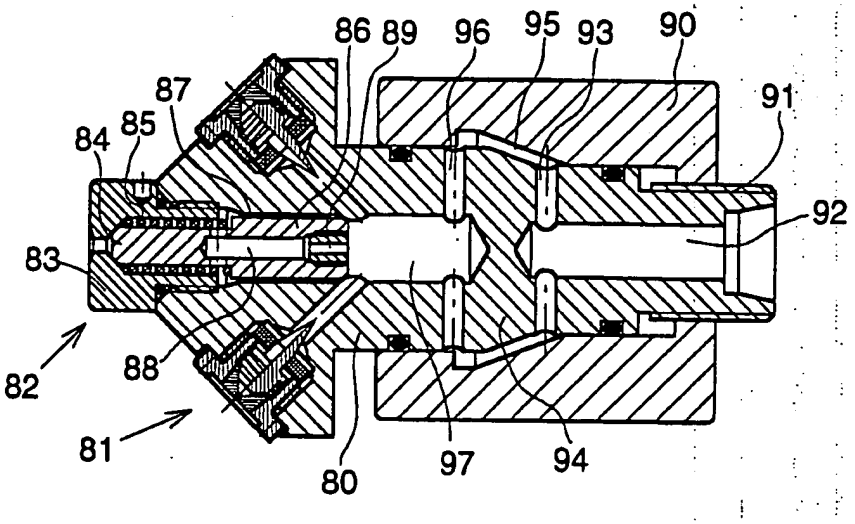
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Fig. 15

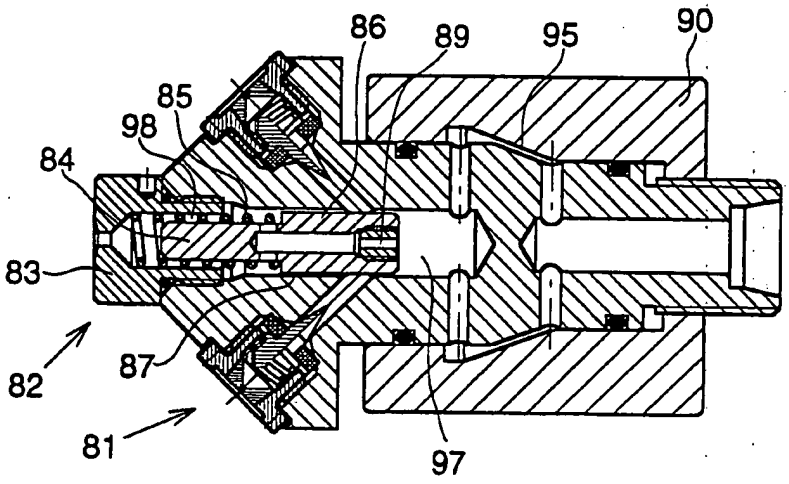
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Fig. 16

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 93/00366

A. CLASSIFICATION OF SUBJECT MATTER

IPC5: A62C 31/03, B05B 1/12, B05B 1/16
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC5: A62C, B05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR, A1, 2339414 (HYDROVIDE), 26 August 1977 (26.08.77), page 1, line 1 - line 13; page 5, line 16 - page 6, line 5	1-4
Y	--	8
Y	WO, A1, 9220453 (SUNDHOLM, GÖRAN), 26 November 1992 (26.11.92), figure 2	8
	--	
X	US, A, 3363842 (R.L. BURNS), 16 January 1968 (16.01.68), column 1, line 19 - line 46	1-4
	--	

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 December 1993	23 -12- 1993
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Ulrika Öhman Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 93/00366

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US, A, 4342426 (GAGLIARDO), 3 August 1982 (03.08.82), abstract ---	1-4
X	US, A, 4664313 (YONEDA), 12 May 1987 (12.05.87), abstract ---	1-4
X	US, A, 4944460 (STEINGASS), 31 July 1990 (31.07.90), abstract ---	1-4
A	DE, A1, 2524856 (PLESSEY HANDEL UND INVESTMENTS AG), 22 January 1976 (22.01.76), figure 4 ---	9
A	Derwent's abstract, No G0207 D/26, week 8126, ABSTRACT OF SU, A1, 770554 (POVOLOTSKII YU A), 20 October 1980 (20.10.80) --- --------	9,10

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

Claims 1-3 directed to a method for fire extinguishing.

Claims 4-12 directed to a device for fire extinguishing.

In claim 1 it is stated that the method is characterized by spraying a combination of liquid fog and a liquid jet. Presumably, what is meant is that the method is characterized by alternating a liquid fog and a liquid jet.

The feature common to all of claims 1 to 12 is that the fire is suppressed by spraying, alternately, a liquid fog or a liquid jet.

However, the search has revealed that it is known to suppress a fire by spraying, alternately, a liquid fog or a liquid jet. This is disclosed in FR,A,2339414.

Consequently, tne common feature is not a special technical feature within the meaning of PCT Rule 13.2, second sentence, since it makes no contribution over the prior art.

Therefore, there is no feature common to claims 2 and 3, and neither is there a feature common to claim groups 5,6,7,9, 10,11,12 and 8,11,12.

The feature according to claim 2 is to suppress the fire by first spraying a liquid fog and thereafter a concentrated liquid jet.

The feature according to claim 3 is to suppress the fire by first spraying a liquid jet and thereafter a liquid fog.

The feature common to claim group 5-7,9-12 is the spray head.

The feature common to claim group 8,11,12 is to have a parallel nozzle for producing a liquid jet.

Since there exists no common feature between claims 2 and 3, or between claim groups 5-7,9-12 and 8,11,12 which can be considered as a special technical feature within the meaning of PCT Rule 13.2, no technical relationship within the meaning of PCT Rule 13 can be seen between the different inventions.

Consequently, it appears that, a posteriori, claims 2 and 3 and claim groups 5-7,9-12 and 8,11,12 do not satisfy the requirement of unity of invention.

No additional fee is required for the inventions according to claim 3 and claim group 8,11,12, because no additional search has to be performed.

INTERNATIONAL SEARCH REPORT

Information on patent family members

27/11/93

International application No.
PCT/FI 93/00366

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR-A1- 2339414	26/08/77	NONE	
WO-A1- 9220453	26/11/92	AU-A- 1689692	30/12/92
		AU-A- 1751092	30/12/92
		WO-A- 9220454	26/11/92
US-A- 3363842	16/01/68	NONE	
US-A- 4342426	03/08/82	NONE	
US-A- 4664313	12/05/87	NONE	
US-A- 4944460	31/07/90	NONE	
DE-A1- 2524856	22/01/76	FR-A- 2276879	30/01/76
		JP-A- 51024910	28/02/76
		SE-A- 7507612	05/01/76